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ABSTRACT

This lecture examines the failure of the United States to produce literate, mathematically competent high school graduates and criticizes "cyclic faddism" as a ploy of desperate educators who keep going back to methods that have been tried and found wanting. Bright spots in education are cited, including the achievement of Jaime Escalante's Hispanic high school students and the performance of the United States in the International Mathematical Olympiad. Suggestions for overhauling school organization include the development of longitudinal teaching teams and development of special accelerated educational opportunities for intellectually talented youth. Public attitudes toward intellectual precocity and brightness are explored. The educational system's tendency to ignore prior academic information about highly able students when making placement decisions is criticized. A model developed by the Study of Mathematically Precocious Youth, known as diagnostic testing followed by prescribed instruction, is described. Virginia's participation in the talent searches of the Center for the Advancement of Academically Talented Youth is noted. An introduction to the lecture, by John M. Nagle, outlines the purpose of the lecture series and offers a brief biography of the lecturer, Julian C. Stanley. (Contains 11 references.) (JDD)

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The College of William and Mary
School of Education Alumni and Friends
Distinguished Lecture Series

MY MANY YEARS OF WORKING WITH THE GIFTED: AN ACADEMIC APPROACH

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Julian C. Stanley
Professor of Psychology
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Study of Mathematically Precocious Youth
Johns Hopkins University

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The Fourth Lecture in the Series
November 12, 1990
Williamsburg, Virginia

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INTRODUCTION

Good evening, and thank you for joining us for this very special event on a lovely fall evening. As Dean of the School of Education at The College of William and Mary, I take great pleasure in welcoming you to this — the fourth annual lecture in the School's Alumni and Friends Distinguished Lecture Series.

Initiated in the fall of 1987, and sponsored and funded entirely by contributions from alumni and friends of the School of Education, this lecture series is designed to provide us all with at least one opportunity each year to view the panorama of educational activities from a position above the melee of daily pursuits. The lecture series is an occasion for reflecting on the broad perspectives and themes that unify the history of education, that illuminate current issues and concerns, and that will animate the future for both education and educators in an increasingly global society. We certainly hope that the novel perspectives, insights, and wisdom offered by each year's distinguished lecturer will provoke and challenge us all as we return to our many professional and personal endeavors. And we hope as well, of course, that the occurrence of these annual lectures will enliven the sense of unity that binds the efforts of all who engage in the wonders of teaching and learning.

In introducing last year's lecture, I was very pleased to be able to announce that Robert and Lois Hornsby of Williamsburg, Virginia, had made a substantial contribution to the School of Education to establish an endowment that will partially support future expenses of the Distinguished Lecture Series. I am equally pleased to be able to announce this evening that two additional donors who wish to remain anonymous have further enhanced the endowment fund for this lecture series during the past year. To these four individuals, and to the more than 450 others who contributed to last year's School of Education Annual Fund, thereby making this evening possible, we are most grateful and most indebted.

The prior three lectures in this new Distinguished Lecture Series were certainly diverse. The inaugural lecture was delivered in 1987 by William and Mary's own Chancellor Professor of Education, John R. Thelin, who discussed the relationship between history and higher education, particularly the use of historical methods to analyze and advance contemporary policy issues affecting colleges and universities. One year later, Professor Emeritus Ralph W. Tyler of the Center for Advanced Study in the Behavioral Sciences shared with us his remarkable perspectives on the unique characteristics and evolving purposes of American education as he had witnessed — and I should add influenced — those characteristics and purposes during an educational career that has now spanned more than 60 years. And then last year, Mary V. Bicouvaris, who was both the 1989 Virginia Teacher of the Year and the 1989 National Teacher of the Year, shared with us her unique views as a classroom teacher on the current demands and efforts to restructure American education. "Mrs. Bic," as she is affectionately known to her social studies students at Bethel High School in Hampton, Virginia, is not only a superb teacher

and articulate speaker, but also a distinguished alumna of our School of Education. There is, of course, a clear connection among these attributes!

Our focus tonight, as Professor Stanley's lecture title indicates, is on the education of especially talented children and youth. Attempts to identify and nurture the gifted have a long, if not always successful, history. More than 4,000 years ago, the Chinese used formal examinations to identify especially competent and talented individuals to fill governmental positions. The competitions began at the local level, advanced to regional levels, and culminated at the national level, where a very small percentage of the winners were picked to become mandarins and members of the nation's ruling elite. While the Chinese cast a wide net to identify individuals with diverse talents, gifted education in the United States has traditionally cast a somewhat narrower net, focusing primarily on children and youth who demonstrate special academic or intellectual skills. And the nation's schools have historically used one of two basic approaches to provide special opportunities for these gifted and talented students. One approach has been to accelerate or speed up school for these students, thereby reducing their total time in the usual thirteen years of elementary and secondary education and the usual four to eight additional years in higher education. The other approach has been to group gifted and talented students in special schools, in special classes within regular programs, or in special part-time or after-school activities and programs. One pundit has observed, perhaps accurately, that programs for the gifted are a little like ice cream cones — attractive to most and available in a variety of sizes and shapes, but not always clear on their benefits to those who partake.

Given, however, the social, educational, and economic importance to the nation of identifying and nurturing our most talented children and youth to the fullest extent possible, I am extremely pleased to introduce to you tonight Professor Julian C. Stanley, who has unprecedented credentials as a psychologist, educational researcher, and advocate for talented children and youth, and who is the founder and current director of the Study of Mathematically Precocious Youth at Johns Hopkins University in Baltimore. Professor Stanley has had a long and distinguished career in education. He began that career immediately after graduation from South Georgia Teachers College (now Georgia Southern University) when he taught high school science and mathematics for five years in Atlanta. Following World War II, he enrolled at Harvard University and completed both his Master's and doctoral degrees in experimental and educational psychology. While working on his doctorate, Professor Stanley was a full-time instructor in education, chair of the editorial board of the prestigious *Harvard Educational Review*, and acting director of the Psycho-Educational Clinic. Between 1949 and 1953, he was on the faculty of both George Peabody College for Teachers and Vanderbilt University, and between 1953 and 1967, he was on the faculty at the University of Wisconsin, where he served as professor of educational psychology, chair of that department, and director of the University's Laboratory of Experimental Design. While at Wisconsin, Professor Stanley and his Northwestern University colleague Donald Campbell wrote a chapter on "experimental and

quasi-experimental designs for research on teaching" that has truly become a classic in the field. With approximately 400,000 copies of that chapter distributed to date, I suspect there are few if any of us with doctoral degrees in education who have not struggled through the Xs and Os of Campbell and Stanley's comprehensive guidelines for establishing the internal and external validity of research designs. During Ralph Tyler's last two years as director of the Center for Advanced Study in the Behavioral Sciences, Professor Stanley was a fellow at the Center, and, since 1967, he has been on the faculty of Johns Hopkins University, where he has been a professor of both psychology and education, and where he has pursued for more than two decades his special interest in identifying, nurturing, and studying exceptionally talented children and youth.

Professor Stanley is author, co-author, or editor of thirteen books and approximately 450 professional articles, notes, chapters, reviews, and technical letters to editors. These include textbooks and monographs on educational measurement, research design, and statistics, and an equally impressive body of literature on matters related to creativity, talent, giftedness, and precocity. He has been the recipient of numerous fellowships and awards, including the most distinguished awards given by the nation's professional associations in psychology, educational research, and gifted education. In 1987, Professor Stanley was named a Distinguished Teacher by the White House Commission on Presidential Scholars.

Professor Stanley has entitled his lecture, "My Many Years of Working with the Gifted: An Academic Approach."

John M. Nagle
Dean, School of Education
November 1990

MY MANY YEARS OF WORKING WITH THE GIFTED: AN ACADEMIC APPROACH

My wife and I thank you for this fine opportunity to visit your lovely city and famed college, the original home of the Phi Beta Kappa Society. I still recall a scene from the musical *1776* in which one member of the Continental Congress was trying to lord it over another by saying, "*I* am a graduate of Harvard College." "Ah," said the other, "But *I* am a graduate of The College of William and Mary!" That stopped the Harvard grad dead in his tracks. As a member of Phi Beta Kappa with two Harvard graduate degrees, I feel the same kind of awe tonight.

When Dean Nagle invited me several months ago to present the fourth annual lecture in this distinguished series, I was intrigued by the prospect. He suggested a more wide-ranging talk than the specialized speeches I usually give. It pleased me that I was encouraged to muse about professional education, in which I have participated for more than half a century, and then to tell you a bit about my perhaps final career — that is, working intensively on behalf of youth who reason exceptionally well mathematically.

Actually, I have had five rather distinct careers. First, from barely age 19 and for nearly five years thereafter, I taught science and mathematics in the lowest socioeconomic level high school in the Atlanta area. Then, for almost four years, I served in the Army Air Corps Chemical Warfare Service during World War II. We transported mustard gas, a messy substance indeed, to England, Algeria, and Italy. After those ten months in the wilds of hot Algeria, you can imagine how apprehensive I became when our troops were recently sent to the Middle East to face the likelihood of a chemical attack from Saddam Hussein.

My third career began as a student in the Harvard University Graduate School of Education almost immediately after the Japanese surrendered. Forty-four months of military service entitled me to benefits of the so-called G.I. Bill, for which I am everlastingly grateful. Four years of graduate study at Harvard compensated for the boredom, frustration, loneliness, and indignities of being a soldier in wartime, and they launched me into the world of academe, a life that even now, 45 years later, I continue to enjoy immensely.

During my last year at Harvard, I was far busier than the fabled one-armed paperhanger who had the hives. Besides being a full-time instructor in education and working constantly on my dissertation, I chaired the editorial board of *Harvard Educational Review*, served as Acting Director of the Psychoeducational Clinic and Master of Palfrey House, counseled all the candidates for master's degrees in educational psychology or guidance, and tried to do much more. After those years at Harvard, almost any academic load seemed light.

During my fourth career, which began in 1948 as a one-year instructor at Harvard and ended in 1971, I was an educational research methodologist. I taught courses in statistics, design of experiments, test theory, test practice, and other

aspects of educational psychology. In fact, during the subsequent four years I spent at George Peabody College for Teachers and Vanderbilt University, I taught ten different courses and took care of virtually all the standardized testing of undergraduates and graduate students. This was excellent background for the more specialized work I later did at the University of Wisconsin and Johns Hopkins University.

My fifth career began with a radical move away from the "dry bones methodology" area, which was mostly technical and not very empirical, to working lovingly and almost fanatically with math-talented boys and girls. Apparently, while in my early fifties, my strong theoretical orientation had become balanced by social concerns. I wanted to find those boys and girls who by age 12 or so and while still in seventh grade showed marked quantitative aptitude. I hoped to provide them with special supplemental and accelerative educational opportunities that I felt they sorely needed and richly deserved. But more about that later.

Some General Impressions About Education

As an educator for more than 50 years in several institutions, both public and private, I have formed opinions about various aspects of education. Chiefly, I have been interested in pre-college academic work. I have tried to avoid being trapped by that archenemy of the aged, what psychologists sometimes call the old bucket delusion: "How dear to my heart are the scenes of my childhood, when fond recollection presents them to view." The "good old days" are largely a myth. Things were not as good as they now are, and they never were!

This was driven home to me by the advent of the electronic computer, particularly after I had banged away for countless weary hours on large, cumbersome, expensive Friden, Marchant, or Monroe calculators, computing statistics that would now take a fraction of a second to compute. At Harvard in 1946, if we arrived late at the computing laboratory, we might have had to use a non-electric machine right out of the nineteenth century that required much ingenuity and manual dexterity to operate accurately. Even with the slow electronic computers of the early days, an intellectually mediocre beginning graduate student could do in a few minutes what earlier would have taken me, a virtuoso of the calculator keyboard, several tedious hours.

With the admission in mind, therefore, that I am wary of purporting to be an expert just because of age and experience, let me explore with you a series of brief propositions about various topics of current interest on the national educational scene. First, like love, education is a many-splendored thing. It is certainly one of the most important and expensive activities in our lives, encompassing much of thirteen years of vigorous youth for most individuals, and seventeen or more years for many. As news sources constantly tell us, our country spends large amounts on public and private education, yet we compare poorly with other industrial nations, particularly in mathematics. This seems especially true below the college level, for graduate work in our best universities is the envy of the world.

What's wrong? Too much TV viewing? Too little reading and homework? Homes that do not or cannot encourage excellent school achievement? Abuse of alcohol and other drugs? Too little effective use of modern technology in schools? Too much part-time employment? No one really knows how to answer these questions or accurately weight the contributions of various factors. Proposed ameliorative procedures usually include reduction in class size, even though this is extremely costly and even though most countries that outdo us educationally have much larger classes than do we. Teachers are often blamed for their students' low achievement, even when it should be clear that societal ills severely limit what teachers can do.

Education is heavily politicized, and apparently becoming increasingly so. There are many hidden agendas and many implicit taboos. For example, mention of racial differences or gender differences in educational readiness is all but outlawed in policy discussions, even though there is considerable professional literature on these differences dating back nearly a century. Intelligence testing *per se* is often proscribed, even though "general intelligence" is one of the very few psychological constructs that have held up under extensive validation. Research findings about the predictive value of intelligence tests repose quietly in low-circulation professional journals or books, either unknown to policy makers or largely ignored by them. Woe be the naive educationist, sociologist, or psychologist who goes public with such information. The fabled tendency of the Greeks to kill the messenger who brings the unwelcome news is still strong. Hardly anyone appreciates a whistle-blower, no matter how scientifically he or she tries to alert the unwary.

Underlying taboos and hypersensitivity are the attempts of many behavioral scientists to ignore or deny the contributions of genetic and congenital predispositions to behavior. Despite studies of monozygotic and dizygotic twins reared together and apart, and despite the vast amount of animal and plant literature about hereditary influences, some of it dating back to Gregor Mendel's work in the 1860s, persons who should know better persist in ignoring this important information when making policy. Genes influence human behavior considerably, although in ways not yet fully understood.

Many attacks on standardized testing arise partly from this kind of omission and confusion. Others involve the competing political demands of various pressure groups. Recently proposed revisions in the College Board's Scholastic Aptitude Test (SAT) are a prime case. Watch your newspapers and popular magazines for the tortuous arguments, many of whose specious rationales are easy to infer.

Given the bad news about our internal and international failure to produce literate, mathematically competent high school graduates, what do the educational policy makers propose? A favorite ploy is what I call "cyclic faddism." Santayana warned us, "Those who cannot remember the past are condemned to repeat it." Desperate educators keep going back to methods that were tried-and-found-wanting, thereby creating a cycle of fads. They move from one promised miraculous

solution to another. Perhaps by creating a constantly moving target, they hope to throw critics off course. They make large changes fast, without pilot testing and without including such essential features of educational experimentation as control groups, and then they announce almost immediately that the new programs and procedures are highly effective. They entice news media to hype these "innovations," and they run little risk of failure, because newspeople rarely stick around long enough to detect the inevitable flaws and weaknesses that occur after the initial euphoria has died down.

Worst affected by these attitudes and behaviors are the nation's inner city schools. Probably no one has the knowledge and managerial expertise to improve urban education radically, given the awful home and community conditions under which many urban students must live. School superintendents come and go, each promising great gains. Parents blame the teachers, most of whom are probably doing the best they know how. Teachers are required, perhaps subtly, to coach the minimum-competency tests (sometimes, exactly the same questions) year after year in what I have termed a "delicate political charade." Very few high school seniors are denied a high school diploma solely on the basis of low minimum-competence-test scores, and most come from homes where parents have no political power to protest effectively.

Are There Any Bright Spots?

While the state of affairs in education may seem to be excessively grim and pessimistic, there are a few bright lights on the educational horizon. Most of you have probably heard about how Jaime Escalante helped Hispanic high school students in Los Angeles concentrate their academic efforts and score well on the difficult College Board Advanced Placement (AP) examination in calculus. You may recall from either the press or the movie, "Stand and Deliver," that these high-scoring students were initially suspected of cheating, because it seemed utterly impossible that so many youth from a deprived area in one of the nation's largest urban centers could possibly learn calculus so well. Later, of course, these students vindicated themselves when they performed equally well on a comparable form of the AP exam under rigidly controlled testing conditions.

We need more, of course, than press reports and movies about an achievement of this importance. I hope that qualified educational evaluators will study the curriculum and instructional procedures used by Mr. Escalante and the subsequent progress of his students in order to determine the long-term effects of the enormous amounts of time and energy that the students and their teacher spent in preparing for this one examination. Clearly, self-esteem was heightened, but what other benefits — or costs — also ensued?

At the very highest levels of mathematics, high school students in this country actually compete very well. Of the 53 countries participating in the International Mathematical Olympiad (IMO) held in the People's Republic of China in 1990, the United States ranked third, behind only China and the Soviet Union. We

chose our contestants carefully, and we prepared them intensively for about four weeks; by contrast, China and the Soviet Union had trained their participants for years.

In the 1989 Olympiad, a Maryland high school senior, Jordan Ellenberg, earned a perfect score, one of only ten that year among the approximately 300 highly able youth who were selected from all over the world to compete in the Olympiad. Jordan also ranked second in the annual prestigious Westinghouse Science Talent Search. As a freshman at Harvard last year, he ranked among the top ten in the national college mathematics Putnam Competition. It is likely that most of you have never heard of Jordan, because even a record like his is not considered by the media to be as newsworthy as the most routine football game between two universities or professional teams. If the press, TV, and popular magazines were to give as much coverage to *educational* achievements as they do to *athletic* ones, we would see a mighty surge forward in the nation's academic achievements. For as one of my mentors, the late, great psychologist B. F. Skinner, fervently believed, positive reinforcement is the *sine qua non* for promoting learning.

There are many other bright spots in the educational firmament. Some may be as illusory as "the thousand points of light" recently featured in political rhetoric. Others may have more substance and durability. Each needs close scrutiny to sift the wheat of educational reform from the chaff of public relations and media enthusiasm. As we engage in this sifting process, mainstreaming, heterogeneous grouping, educational acceleration of various kinds, mentoring, cooperative learning, role modeling, self-esteem enhancement, vouchers, local control, a longer school year or day, ungraded primary schools, and myriad other curricular revisions come readily to mind.

One Specific Suggestion: Longitudinal Teaching Teams

For a number of years, I have believed that the basis of school organization needs a radical overhaul. Schools have blundered into the pernicious lock-step structure of age-in-grade Carnegie Units. Students are forced for at least thirteen years to march along at the tempo of their agemates, rather than be allowed to proceed according to their own carefully measured progress in each school subject. Much of the time, school subjects must be studied 45 or 50 minutes each day five days each week for a semester or a school year, simply because long ago a commission set up by the Carnegie Foundation for the Advancement of Teaching found that particular unit of time and frequency to be a useful yardstick for determining whether teachers were full-time and therefore qualified to participate in a pension program. This awkward, age-anchored, blocking system, unresponsive to individual differences and not used in many other countries, may have helped facilitate the book-keeping tasks of assigning letter or percentage grades in courses

each quarter or semester, but it certainly has not contributed to sound curriculum and instruction.

I am reminded of Procrustes, the giant innkeeper in Greek mythology who tied travelers to an iron bed and then amputated or stretched their legs until they fitted it. The Carnegie unit is a "Procrustean solution," for the least able student is expected either to learn as much as the ablest in the same length of time or to receive a lower grade. Most students are moved up regularly, one grade per year, even if they have little preparation for the next higher grade. And those not promoted usually fail to benefit from the retention, partly because their special academic needs have not been met. More of the same is simply not right for them.

My proposed solution is "longitudinal teaching teams" from kindergarten through the twelfth grade. For example, in mathematics, there would be a comprehensive learning center in which students would proceed strictly according to their actual learning of the subject. Every student would have to attain considerable mastery of mathematics (not merely minimum competence!) before being certified in that area. Some might accomplish this in a few years. A few might have to plug away at it right up to the point of graduation from high school. There would be no age-grading and no report-card grades. Only progress to date would be reported, and no one would fail a course. Those who attained the designated level in mathematics before the last minute would have the option of moving ahead further in that subject or of devoting their former math time to some other subject or activity. Of course, the math learning center would require skilled teachers at all levels, from those most effective with slow learners to those most effective with the ablest students.

Similarly designed longitudinal teaching teams and learning centers seem to me desirable in other areas as well, including language arts, science, foreign languages, social studies, the performing and practical arts, and physical education. School would become a cluster of learning centers. I proposed this idea in print more than a decade ago, but am not yet aware of any takers. The logistics of making the change are formidable, and undoubtedly the initial costs would be great. I fear, however, that most other approaches are merely stopgaps, because they do not attack directly the root cause of the current widespread failure to build solidly, a step at a time, on each student's actual learning.

Special Accelerated Educational Opportunities for Intellectually Talented Youth

Rather than wait for an educational utopia in which all students are taught appropriately according to their prior knowledge, learning rate, and interests, I have chosen to initiate a plan whereby the academic efforts of schools as they are currently constituted can be supplemented. Because my own background and even my graduate training have emphasized mathematics and science, and because I have special interest in highly talented students, I have confined my

efforts to working with youth who reason exceptionally well mathematically. My vehicle is called the Study of Mathematically Precocious Youth (SMPY).

SMPY began at Johns Hopkins University in 1971, greatly aided by a five-year grant from the newly formed Spencer Foundation. Half a year after it started, SMPY inaugurated an annual regional search for youth who reason exceptionally well mathematically. Soon thereafter, a fast-paced pre-calculus class for seventh graders was conducted on Saturday mornings. A newsletter was started. In less than a decade, talent searching, special academic classes, and newsletters quickly spread across the country, leading to the creation of various university-based centers to facilitate the educational development of mathematically and/or verbally talented pre-college students. By 1979, SMPY itself began concentrating on finding and helping boys and girls who before age 13 scored at least 700 on the mathematical part of the College Board Scholastic Aptitude Test (SAT-M). Since 1972, approximately 1000 of these phenomenal mathematical reasoners (the top individuals in 10,000 of their age group) have been identified, informed, stimulated, and followed to determine which supplemental educational opportunities will further their educational and personal development best.

SMPY is founded on the pioneering work of Lewis Terman of Stanford University, who during the 1920s searched California for high-IQ students, and Leta Hollingworth of Teachers College, Columbia University. My own motivation, however, is largely personal. As a high school student, I had been rather good at math, science, and other subjects, but found the pace excruciatingly slow. Over the years, it slowly dawned on me that I, and other students as able as I or much abler, could have accomplished far more academically in the period of time permitted by the usual school routine and that we would have enjoyed doing so.

The Inspiration for My Interest in the Gifted

This realization came slowly, first in the summer of 1938, after a year of high school teaching, when I was enrolled in graduate courses at the University of Georgia. One of these, a traditional course on tests and measurements, opened new vistas for me. Over the years, however, other interests and demands intruded, and only occasionally did I give talks about giftedness or write papers concerning it. Finally, in 1971, the bug really bit me.

Actually, I was motivated most by several lines of poetry. For example, the eighteenth-century poet Thomas Gray led me to want to prevent what he called the "mute, inglorious Miltons" buried in a village graveyard. In his exquisite "Elegy Written in a Country Churchyard," Gray succinctly summarized two and a half centuries ago the motivation for SMPY:

> Full many a gem of purest ray serene
> The dark unfathomed caves of ocean bear:
> Full many a flower is born to blush unseen
> And waste its sweetness on the desert air.

During World War II, I had seen many personnel records and had informally compared Army General Classification Test (AGCT) scores, an approximate measure of intelligence, with soldiers' educational and occupational backgrounds. It became obvious to me that some of the top scorers had badly missed the educational and vocational opportunities appropriate for them. For example, the highest-scoring enlisted man in our bomber command headquarters was a 30-year-old high school graduate from Connecticut who had been a postal clerk prior to joining the Army. On the AGCT, he had scored far above a Yale University Ph.D. degree recipient in the humanities and a New York lawyer. Even then in 1944, it occurred to me vaguely that, to update Gray's immortal words, "Many brilliant persons will not have their intellectual potentialities recognized and nurtured properly." What if these individuals' high scores had been known earlier and had formed a basis for maximizing the effective use of their abilities? I resolved, rather dimly at the time, to do something about this seeming waste of talent.

The poet Robert Browning gave me a clue as to how this might be accomplished, although he couched it in the male chauvinistic idiom of his era: "Ah, but a man's reach should exceed his grasp, or what's a heaven for?" In his "Ulysses," Tennyson stated it somewhat differently when he wrote, "To strive, to seek, to find, and not to yield." Ability plus appropriate-level opportunity *plus* strong motivation can indeed lead to great accomplishments, where otherwise there might be only mediocre achievement.

Keats added the aesthetic component in his lines, "Beauty is truth, truth beauty — that is all/Ye know on earth, and all ye need to know." Great theoretical orientation without a keen sense of form, beauty, and harmony is not likely to result in creative research that meets the criterion of elegance. In mathematics, an elegant approach to problem solving employs the most suitable techniques and achieves a parsimonious solution that leaves the mathematician aglow with a feeling of fulfillment and "just-rightness;" analogously, a researcher in the sciences achieves elegance by using empiricism in wondrously effective ways to elucidate the keys to some of nature's most important mysteries.

Yet another poet has contributed wisdom to the pursuit of excellence. In his famous lines from "The Ballad of East and West," which are usually quoted only in part and therefore misleadingly, Rudyard Kipling wrote:

> Oh East is East, and West is West, and never the twain shall meet,
> Till Earth and Sky stand presently at God's great Judgment Seat;
> But there is neither East nor West, Border, nor Breed, nor Birth,
> When two strong men stand face to face, though they come from the ends of the earth!

Read Kipling's "two strong men" as "intellectually highly talented youth" and you have a summing up of the rationale for my work and that of others who also cherish great academic potential. We believe that such talent transcends sex,

circumstance, and nationality and mandates special educational treatment of intellectual prodigies in their areas of great ability. We consider accelerative procedures crucial, because, to paraphrase Browning, "An intellectually precocious youth's reach should exceed his or her grasp, or what's an educational system for?" Acceleration in the company of one's true *intellectual* peers, who may not be one's agemates, can result in stimulating role modeling that forges lasting academic and social bonds among highly talented youth — that is, among Kipling's strong young men and women. SMPY and its many offshoots try to extend both the reach and the grasp of our talented protégés, with all these facets of human growth and development firmly in mind.

Objections to Precocity and Brightness

As its name indicates, SMPY is interested almost exclusively in mathematically precocious boys and girls. But what *is* intellectual precocity?

The *Oxford English Dictionary* (OED) defines "precocity" as "early maturity, premature development," and so it describes "precocious" individuals as those who are "prematurely developed in some faculty or proclivity." The use of "premature" and "prematurely" to define precocity seems pejorative, but, because the concept as applied to the psychological qualities of persons is somewhat figurative, this connotation may not be intended by the OED. Physical precocity of seed, plant, or animal does not necessarily connote abnormality in the sense that psychologists usually employ that word.

Authors throughout the years, and especially during the nineteenth century, seem to have had mixed feelings about precocity. For example, Thackeray may have helped coin the familiar expression "precocious brat" when in 1855 he wrote, "Poverty and necessity force this precociousness on the poor little brat." And yet, later in 1863, he wrote of a boy in one of his novels that "his 'Love Lays' . . . were pronounced to be wonderfully precocious for a young gentleman then only thirteen."

Shakespeare helped further the myth that precocity is intrinsically unhealthful when he wrote in *Richard III*, "So wise so young, they say, do never live long." The great French writer Musset combined both points of view succinctly when he wrote, "How glorious it is — and also how painful — to be an exception." The famous nineteenth century American writer Margaret Fuller warned that "for precocity some great price is always demanded sooner or later in life." In 1829, Southey summed up the layman's view of both natural and induced precocity when he wrote, "And as natural precocity is always to be regarded with fear, so the precociousness which art produces cannot be without its dangers." Nine years earlier, William Hazlitt, British critic and essayist, had noted that the works of some English writers "bear the marks of precocity and premature decay."

Thus it is understandable that many persons, especially parents, tend to view extreme brightness or special mental talents with some foreboding. Yet early *physical* prowess or *musical* ability is often lauded. It is not considered psychologi-

cally abnormal for a child to play baseball skillfully, compose music, or perform in a ballet unusually well when quite young, but it may be considered abnormal if he or she can readily extract the square roots of numbers when only five years old. For complex, not fully understood reasons, many citizens of the United States are strongly anti-intellectual. As we have already noted, this pessimistic or even hostile attitude toward the intellectually gifted is not new, although our compulsory, lock-step, age-in-grade educational system may have intensified the hostility. High IQs are not in fashion. I sometimes wonder if, before long, some state legislature may actually try to repeal high IQs, as one such body a few decades ago is alleged to have considered repealing the law of gravity!

Let us not, however, be either pessimistic or defensive about SMPY's ability to identify and help a sizable number of mathematically highly talented youth. My associates and I do not consider that boys and girls who are able to reason unusually well mathematically are destined to die young, burn out intellectually, develop lopsidedly, or become mediocre adults. Fortunately, these are more than articles of faith, for intellectually gifted individuals have been studied intensively and extensively for nearly a century, and results show clearly that the popular stereotypes are invalid.

SMPY's DT-PI Model

It seems to me that one of the tragedies of our educational system is the way it tends to ignore, except for course grades, prior academic information about highly able students as they enter a new class in the fall of a school year. For example, during the 1970s we discovered that about half of the 12-year-olds who scored 500 or more on SAT-M knew more algebra, as judged by their performance on a standardized algebra test, *before* they took their first algebra course than half of the students who had completed a year-long course in that subject.

This tendency to ignore academic information about students when making placement decisions was brought home to us even more dramatically when the top scorer in our January 1974 mathematics talent search, a 12-year-old seventh grader who scored 760 on SAT-M, tried to enroll in first-year algebra in his junior high school midway through the school year. The math teacher told him that he would not be permitted to do so for two reasons: first, he was only a seventh grader, and no student below the eighth grade had ever been allowed to take the course; and second, he had already missed the first half of the course and therefore could not possibly "catch up" with the class. The boy called me, bitterly disappointed. I talked the teacher into administering to him the Cooperative Mathematics Test for Algebra I, a timed test that consists of 40 rather difficult multiple-choice questions. This mathematically brilliant youth made a perfect score, whereas only 1 percent of the national end-of-year norm group scored 36 or more. When the teacher saw these results, he said to the student something perhaps characteristic of the mind set of many teachers: "You really *are* ready to begin Algebra I." "No."

the boy replied, "Obviously, I *already* know the material of that course well." He subsequently skipped all mathematics in his regular schools, from Algebra I onward, and instead took honors college mathematics courses at the University of Maryland. As a senior in high school, he represented the United States on the six-person International Mathematical Olympiad team and won a silver medal.

What might have happened to this mathematically precocious student if I had not been available and able to intervene? Presumably, when he became an eighth grader, he would have had to spend at least 135 hours "studying" first-year algebra. When he started that course, he would have had, unbeknown to the teacher, sufficient knowledge of the subject to score 40 out of 40 on a standardized achievement test in Algebra I. After lazing through the course, he might perhaps have scored 37 or so because of habitual inattentiveness, and the teacher probably would have taken full credit for the 37 points, without ever being aware that the experience may have cost the boy much of his interest in mathematics.

Along the same lines was the plight of an especially enterprising young man who completed two semesters of physics at a local college with grades of "A" for both semesters. When he brought the official transcript of his college physics work to his high school principal and asked exemption from high school physics, the principal responded that he could not give the boy credit for high school physics because that would be counting the college work twice. Of course, logically this is akin to saying that a person is six feet tall, but not five feet tall.

We despair that a youngster can be widely known as a "math genius" from kindergarten onward and yet be treated upon entering each successive mathematics class as if he or she were starting from the typical baseline for the end of the preceding course. It seldom seems to occur to teachers to administer systematic diagnostic tests at the start of each course and thereby help already knowledgeable entrants avoid unnecessary repetition, boredom, and frustration. Some students need not start on page 1 of the textbook and work through every page to the end.

These considerations led those of us at SMPY to develop our DT-PI model: diagnostic testing followed by prescribed instruction. By applying this model, we find out what a youth does not yet know about a subject, and then we help her or him learn just that, rather than kill the student's motivation by requiring her or him to plod through the entire textbook and other class materials.

"Yes," many gifted-child specialists might counter, "But why not just 'enrich' Algebra I for the ablest?" In our extensive experience, enriched Algebra I is often busy work or a covert form of Algebra II. The mathematically exceptionally talented student could readily complete two years of algebra excellently in one if properly diagnosed and helped with just those elements essential for her or him. In this way, the DT-PI model guides instruction in our many fast-paced mathematics classes. It enables students in these special groups, all of whom have scored at least 500 on SAT-M before age 13, to learn from one to four and a half years of pre-calculus extremely well in far fewer hours than would be required in a regular school setting. A few of the ablest students come with little formal credit in mathematics and return home at the end of the summer fully ready for Advanced

Placement calculus. Others complete "only" a year or two of algebra in their three intensive weeks at one of the residential summer programs.

The Achievements of Students After SMPY

As is illustrated by the remarkable achievements of some of the students who have participated in SMPY's "700-800 on SAT-M Before Age 13 Group," the DT-PI model works miracles for eager, math-talented boys and girls.

- Before age 13, a boy in Australia had won a gold medal in the high school International Mathematical Olympiad competition; at age 10 he had won a bronze medal.
- Before he was 11, a boy in North Carolina had twice made the highest possible score of 800 on the mathematical part of the SAT. Only 1 percent of college-bound male high school seniors score 760 or higher on that part of the SAT.
- A Michigan boy scored 800 at age 12 and went on to graduate from Harvard at age 20, *summa cum laude* in physics.
- A 19-year-old female philosophy major was first in her graduating class at the University of California at Berkeley.
- Another young woman won the top graduation award at Harvard.
- A young man who participated in the first year of SMPY is now a tenured associate professor at the Wharton School of the University of Pennsylvania. He completed his Ph.D. at the University of Chicago the month he became 22 years old.
- Two members of SMPY's high-math group recently earned their Ph.D. degrees at the California Institute of Technology, one in theoretical physics at age 21 and the other in biophysics at age 24. Both are now postdoctoral fellows in major universities.
- And another participant in SMPY earned her Ph.D. degree in mathematics from the Massachusetts Institute of Technology at age 21.

Not all high honors earned by the group are academic. For example, the president of the student council at a major university last year is a member of SMPY's 700-800M group, another member of the group is on leave from Stanford to play professional racquetball, the boy who graduated from Harvard near the top of his class played varsity high school football and hockey when fifteen years old, and quite a few members of the group have won music performing awards.

Difficulty of Funding Research on Giftedness

A grave problem encountered by nearly everyone who tries to help the gifted is the lack of funding to support these efforts. Perusal of the annual reports of many large philanthropic foundations indicates that the grants awarded to conduct research tend to be dominated by emphasis on "minorities," usually

meaning Blacks, Hispanics, and sometimes girls and women. Descriptors such as disadvantaged, poor, disadvantaged gifted, handicapped gifted, low-income children, deprived families, compensatory education, teen-age pregnancy, AIDS, and substance abuse dwarf references to intelligence, brightness, unqualified giftedness, high IQ, intellectual talent, educational acceleration, precocity, and prodigy.

Programs to help able youth are even more difficult to finance than is research about them. For example, the National Science Foundation funds some summer programs for above-average junior high school students, but only if the programs are not accelerated — that is, if they do not cover any of the subjects usually taught in junior high school and so do not become a substitute for required courses when the participant returns to school in the fall. This rules out funding for many excellent academic programs across the country.

For less than a million dollars each year, every young person who scores at least 500 on SAT-M before age 13 and also at least 930 on the combined SAT verbal plus math score, among the 100,000 youth who take the SAT each year, could be given a $200 scholarship to help him or her enroll in an academic summer program. This small amount of money per student would encourage many parents to provide the rest of the cost, rather than waste the scholarship. The stimulus to better utilization of exceptional quantitative talent and to better social development would be vast. Yet the cost is relatively minuscule. Smaller classes, better prepared and better paid teachers, and various local options simply will not do the job properly for youth who reason exceptionally well mathematically or verbally. They need special, supplemental, accelerative educational opportunities to augment the work of the schools.

Benefits to Virginia

What have SMPY and the organization it created at Johns Hopkins in 1979, the Center for the Advancement of Academically Talented Youth (CTY), done for boys and girls in Virginia? Your state has participated in the annual talent search every year since the 1970s. Its entrants, chiefly seventh graders, have scored well, especially verbally. In 1990, 3625 of them took the entire Scholastic Aptitude Test in CTY's January session. Of those, 18 percent of the boys and 16 percent of the girls attained the verbal honors score of at least 430, and 22 percent of the boys and 12 percent of the girls attained the mathematics honors score of at least 500. Many of these students qualified for CTY's three-week academic residential summer courses.

CTY's national talent search also has strong indirect effects, for it encourages school systems to develop more flexible curricula and to articulate summer academic experiences with regular-year courses. For example, a boy or girl who learns the first year of algebra well during CTY's summer program should not have to repeat that instruction during the following school year, but should have the opportunity to be placed in the second-year algebra class in the fall.

The chief purpose, however, of such talent searches among seventh graders is informational. Boys and girls who are allowed to take the SAT in CTY's search already know that they have scored at the 97th percentile or above — that is, in the top 3 percent — on the mathematical, verbal, or composite of a nationally standardized achievement test battery administered as part of their school's regular testing program. What they need to know is how well they compare with other "gifted" children in order to plan appropriate supplementary education and seek needed curricular flexibility. This is information that schools usually cannot provide, but that CTY can by interpreting the students' three scores on the SAT (math, verbal, and standard written English) and then offering them suggestions about how to proceed educationally.

Conclusion

It is exciting to work closely with intellectually talented youths. Most of them sparkle with enthusiasm for a high-level, rigorous academic diet. They need the opportunity and means to move ahead faster and better in those academic areas where their minds work especially well. Results can be thrilling to them, their parents, their teachers, and especially SMPY and other organizations devoted to enhancing their development. These fine outcomes should also be viewed as invaluable for our nation, for many of these high scorers on the SAT will become the country's intellectual leaders of the near future. Their mental ability and learning readiness are among the rarest and most precious natural resources we have. It behooves us all to help them forge ahead, preferably with a good balance of academic work, athletics, and performing arts. They should strive to become well-adjusted, happy, effective adults, but the intellectual side need not — indeed, must not — be slighted in favor of other aspects of development.

There is no danger of providing too much supplemental education for intellectually exceptionally talented girls and boys. They deserve the very best educational opportunities possible. During the perhaps troubled years ahead, our nation needs all the superbly developed talent attainable. SMPY and its many offshoots across the country and elsewhere are certainly worthwhile drops in the proverbial bucket, but far more than mere drops are crucially needed in gifted education, especially from the public sector. I urge you to think deeply about how you and the various enterprises and activities with which you are associated can help raise the education of gifted youth to the most desirable levels.

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